

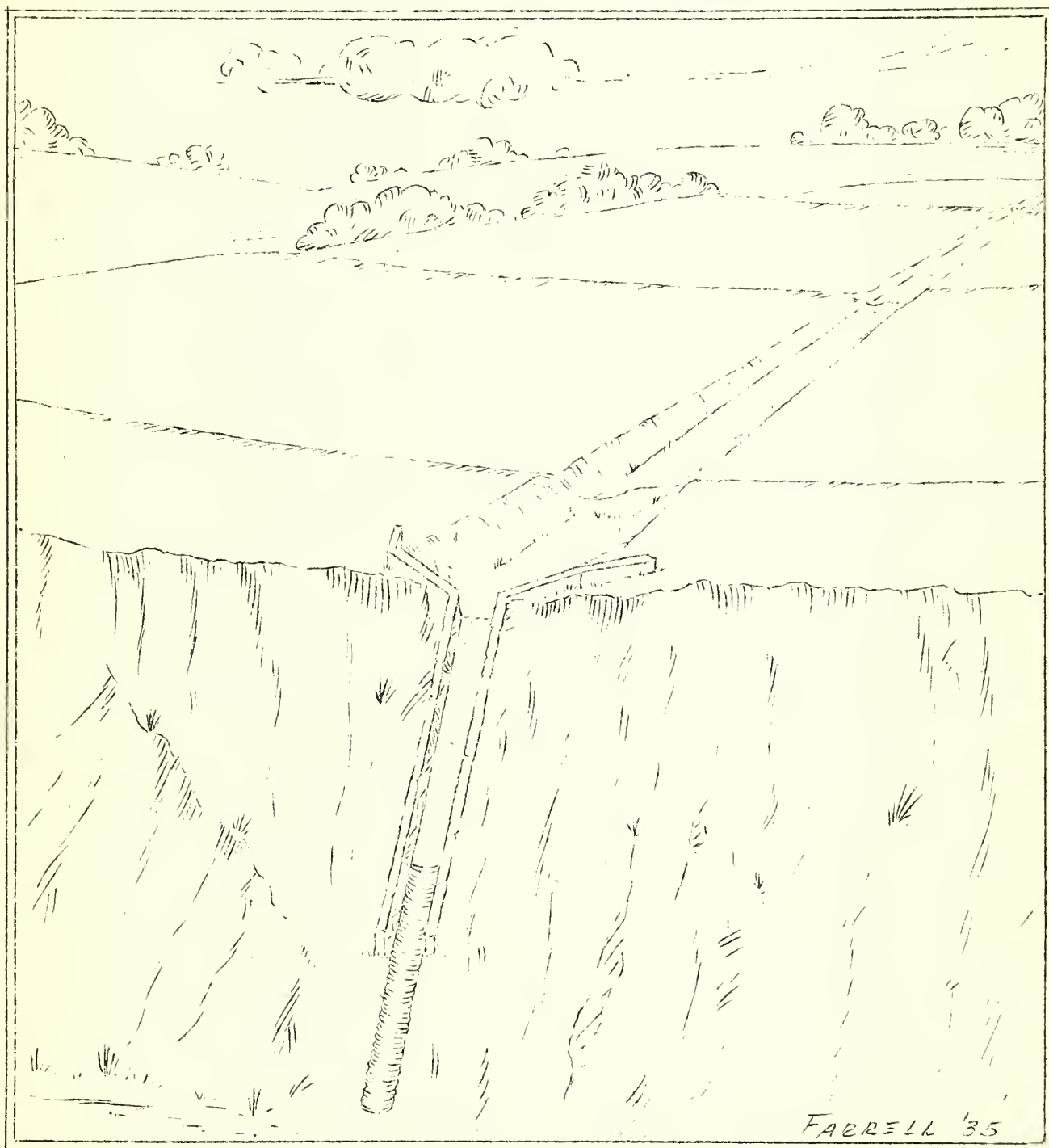
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CALIFORNIA EROSION DIGEST

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UNITED STATES DEPARTMENT OF THE INTERIOR
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HARRY E. REDDICK - REGIONAL DIRECTOR - SANTA PAULA, CAL.

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HARRY E. REDDICK, Regional Director
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THE SLEEPING GIANT, PUBLIC OPINION, AWAKENS! REALIZATION OF NECESSITY FOR SOIL EROSION CONTROL MEASURES SEEN.

The drive against soil erosion is increasing day by day as more and more people are being made aware of the necessity for instituting measures of control. Through the medium of newspapers, radio, tours of demonstration areas, talks before farm center meetings and service clubs, and personal contacts, the message is being spread, not only in those sections of the state where valuable top soil is being swept off the land with every intense rain, but in towns and cities as well.

After all, the residents of urban communities should be vitally interested in the problem. What helps the farmer helps all of us. Town and country are dependent upon one another. If soil erosion is allowed to go on unhindered, it robs the farmer of his capital, the precious, humus laden, six or seven inches of top soil. Once that is gone the chances of making a decent living are gone and the merchant in town is deprived of a good customer. Farming bankrupt soil means Poverty, and Poverty buys few cars, radios, dental care or tickets to the theater.

Harry E. Reddick,
Regional Director.

AN OUTLINE OF SOIL EROSION AND SOIL EROSION CONTROL

Since the primary concern of the California Project of the S.E.S. is the control of erosion from rainwash the following outline is indicative of the problem.

I. Sheet Erosion - Loss of surface soil

1. Vegetative Control.

- (1) Reforestation or afforestation of non-agricultural land.
- (2) Return to native cover slopes unprofitable to farm.
- (3) Cover crops for protection during period of greatest rainfall.
- (4) Strip crops on slopes not cover cropped.

2. Mechanical Control.

- (1) Contour plowing or subsoiling.
- (2) Hole digging.
- (3) Terracing.
- (4) Contour or grade ditching.

II. Gullying - Cutting in water courses

1. Vegetative Control.

- (1) Vegetation to prevent sheet erosion from developing into gullying.
- (2) Head control by tree planting at the beginning of gullies.
- (3) Bank stabilization by sloping and vegetating.
- (4) Consolidating and holding silt in water courses with plant roots.

2. Mechanical Control.

- (1) Head control by flumes and chutes.
- (2) Diversion ditches.
- (3) Dams.

A. Permeable.

- (a) Bean straw and earth.
- (b) Brush.
- (c) Pipe or post and wire.

B. Impermeable.

- (a) Earth fill with spillway.
- (b) " " " Culvert.
- (c) " " " " and riser.
- (d) Redwood.
- (e) Log.
- (f) Concrete log.
- (g) Slab rock.
- (h) Concrete rock fill.
- (i) " circular crest.

A discussion of one or more phases of each method of vegetative and mechanical control will appear in each issue of the Digest along with the comments upon the influence of soil type upon the practicability of the particular control methods.

FACTS THE COOPERATOR SHOULD KNOW ABOUT THE BROAD-BASE TERRACE.

by

J. G. Barnesberger, Chief Agricultural Engineer
and

L. Waters, Assistant Agricultural Engineer

Use of the broad base terrace is part of the coordinated program of the U. S. Soil Erosion Service for controlling washing of soil from sloping land planted to clean cultivated crops. It is a type which has been used widely, particularly in the southern and mid-western states and has almost entirely superseded the ridge type terrace and the field ditch. It is sometimes known as the Mangum terrace, from the name of the North Carolina farmer, who developed it from the field ditch, in 1866.

A recent report from the Washington office of the Soil Erosion Service states that more than 3,500 ^{miles of} terraces have been completed on the demonstration projects, located in thirty-one states. A number of these have been built in the Las Posas Project.

A broad base terrace is in reality a wide, shallow ditch, or channel, located across a slope on the contour, or with less than one per cent grade. A broad ridge of earth scraped up on the lower side prevents the water not absorbed by the soil above the ditch from breaking through down the slope and changes its direction of flow to across the slope, reducing the velocity of the moving water, thereby providing more time for absorption by the soil. A terrace grade sufficient to carry off the excess water is therefore provided, but the movement is slowed down and the width of the ditch insures the absorption of much of the excess water.

The soil type influences the grade of a terrace. Moderately permeable soils, which absorb water slowly, require a steeper grade than loam or sandy soils, which absorb water rapidly. Usually the first 300 feet of a terrace will be level or with a fall of not to exceed $\frac{1}{2}$ inch per 100 feet in length. The second 300 feet may have a fall of 1" per 100 feet, the rate of fall increasing until in the last 300 feet the fall may be 6 inches per 100 feet. No terraces over 1500 feet in length have been constructed in the Las Posas area.

Slopes up to 12 per cent may be terraced, but on steeper slopes the number of terraces increases to the point of impracticability. Spacing of terraces depends chiefly upon two factors: degree of slope and soil type. Terraces, on the steeper fields in the Las Posas, are spaced from 60 to 100 feet between channels. On more level ground this distance may range from 100 to 150 feet.

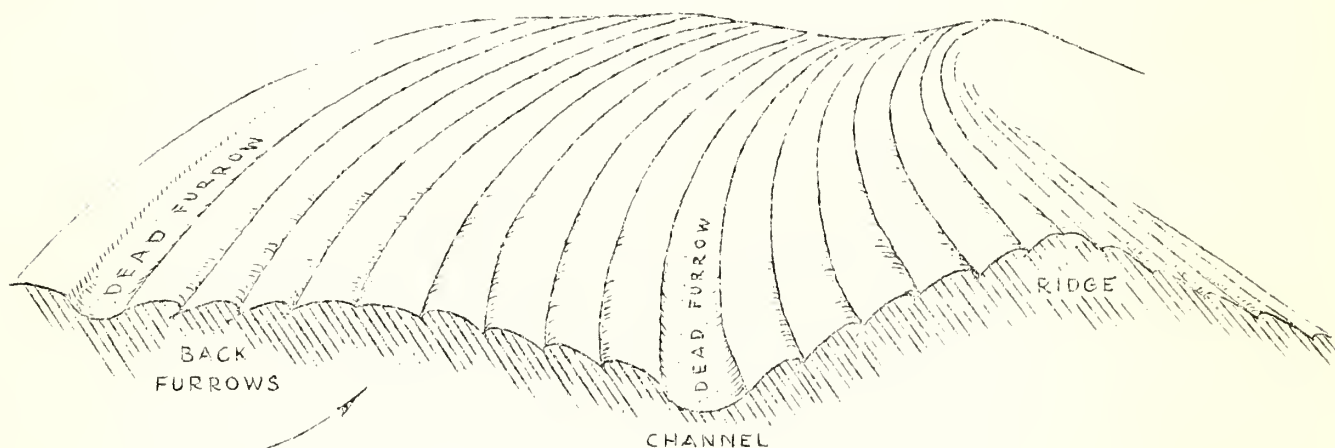
When the terraces are first completed the cooperator may believe them a formidable obstacle to cultivation. The terrace is, before settling, from 2 to 3 feet high, 4 to 6 feet across the top, the sides having a slope of approximately 3 to 1 and the base is from 18 to 25 feet wide. However, after settling and working by the cooperator, the terraces flatten to approximately 18 inches in height, and from 25 to 30 feet across the base. When this form is reached they present no difficulties to farm operations.

The illustration shows the methods recommended for plowing terraced land. All deep cultivation should be on the contour. A plow or subsoiler should never cut across the ridge or bank, since a channel may be formed for water to break through. Planting on the contour may be desirable for the first year, but if the terraces are approximately parallel point rows may be eliminated.

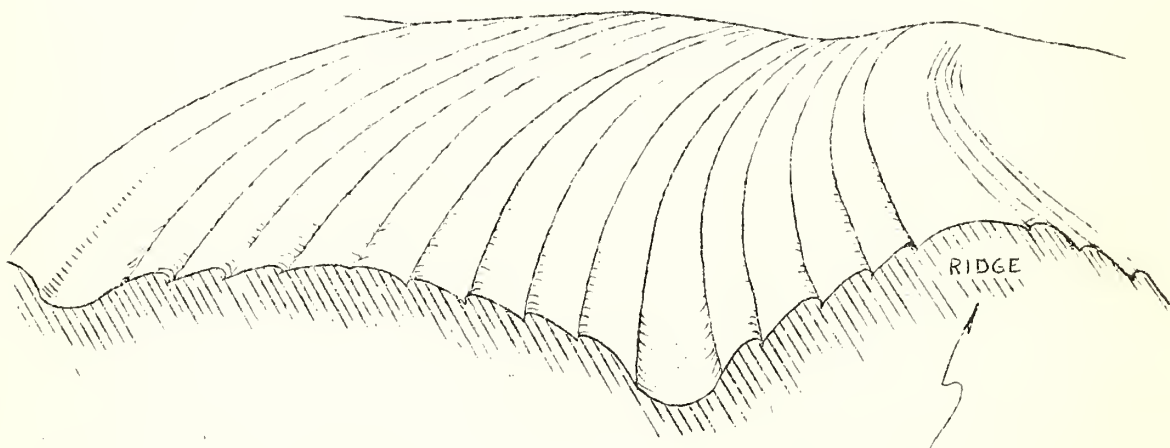
The first year, and possibly the second, terrace channels will collect ponds of water where gullies existed, but after continued cultivation the depressions are filled, eliminating the ponds.

Terraces in the Las Posas have been constructed with tractor and grader. An example of the efficiency of this method was demonstrated by the construction of a terrace, half a mile long, in less than three hours. This was on ground where subsoiling was unnecessary.

Methods of Plowing Terraced Land



First year - Throw furrows to top of ridge to compensate for settling.



Throw furrows down sides of ridge after first year to broaden ridge.

One last suggestion to the cooperator: When the grading is completed plow or subsoil along the base of the terrace ridge, filling in depressions above or below the ridge.

NOTES ON OUTLETS FOR BROAD-BASE TERRACES

by

J. B. Chapler, Assistant Agricultural Engineer.

On page 12 of Farmers' Bulletin No. 1669 of the U. S. Department of Agriculture, entitled "FARM TERRACING", under the sub-heading of "Laying off Terraces", the following statement is made: "In laying off a system of terraces it is first necessary to provide for suitable outlets". It is the opinion of the writer, from experience in the field, that the statement quoted above should be given great emphasis in any instructions relative to the construction and arrangement of terraces.

There are various factors affecting the number, type and cost of terrace outlets. Among these factors are the contour and slope of the area to be terraced, the topography of contiguous areas and the location and depth of natural drainage channels.

In the Las Posas Valley many of the natural drainage channels are so deep and the banks so steep that substantial inlet structures and lined chutes or pipes are necessary to conduct the water into them from the terraces. Such installations are naturally rather expensive and it is, therefore, advisable to collect the water from as many terraces as possible into one principal outlet. This may be accomplished by means of an open ditch running transversely to the terraces, or by running contour ditches from the lower ends of several terraces to a common outlet.

In this area various types of terrace outlets have been constructed, ranging from small hand-excavated ditches into existing shallow washes, to masonry or concrete structures consisting of headwalls of considerable size with wings, floors and cut-off walls, and open concrete or rubble masonry chutes, 40 to 50 feet in length. It will be readily understood from the above statement that the cost per unit of these outlets is extremely variable.

It is difficult in many cases to separate the cost of terrace outlets from gully control costs. Where the terraces drain into a small natural channel across the field it is generally necessary to place small dams in the channel, just below each terrace outlet. In most cases, however, it would be advisable to install such dams even though no terracing is done, so a portion, if not all, of the cost of these dams should be charged to gully control.

One terraced area of 26 acres, is an example of a combination of terrace outlets with gully control. There are 24 short terraces with an aggregate length of 9255 feet. These terraces drain into a small natural channel in which it was necessary to install a small dam just below each terrace outlet.

Many of the more expensive outlet structures conducting the terrace drainage into deep barrancas are located and constructed at points where it would be advisable, even though no terraces were built, to install such structures for the prevention of "fingering" of the barrancas by water-fall erosion. Such structures are in reality gully control measures, although locally they are usually referred to as "head controls".

Examples of the most elaborate types of outlet structures will be found emptying into the Puerta Zuela Barranca, which is wide and deep. Other examples of somewhat less costly structures spill their water into the Fox Barranca, which is also very deep.

MEASURING SOIL AND WATER LOST FROM CULTIVATED HILLS.

by

P. B. Dickey, Junior Agronomist.

Rain is an undoubted blessing but when it is allowed to run unhindered from clean cultivated, sloping fields, much of the water and a good deal of the top soil is lost when the intensity of the rain is such that the soil cannot absorb it fast enough. On sample plots in the Las Posas experiments have been conducted to show soil and water losses from lands protected by various types of cover and from those that represent fallowed fields.

A series of measuring devices were installed last fall at the lower ends of six 1/100 acre plots. The unit aliquot measuring system consists of a concentration funnel to conduct all the water and soil running off the plot into a settling tank where most of the soil particles settle out. The water continues through a divisor box with eleven equal-sized slots at the lower end. The flow from one of these openings is conducted into a second divisor box with five equal slots at the lower end. One fifth of the water from this small divisor empties into a catch tank, and theoretically is 1/55 of the total runoff. The water not caught is carried away by a trough to a well vegetated area where it will not cause erosion.

The amount of soil lost from these 1/100 acre plots is measured by taking samples of the soil and water in each part of the divisor system and calculating the percent of soil by volume and by weight on an oven dry basis.

The results thus obtained from four rain storms are shown in Tables I and II. Each plot was planted to a different crop to learn which type of crop best prevented loss of soil and water. Table III ranks each cover according to its value in checking soil erosion and water runoff. In averaging the ranks of cover crop the size and age of the crop was taken into consideration in case of a tie, e.g., plots 8, 9, and 13, placed differently, the order being for lesser storms 13, 8, 9, while for larger storms the order was 8, 9, 13 in preventing water runoff. Plot No. 13 which has a cover of Sudan grass was able to take up more water than plots 8 and 9 from light rainfalls but appeared to reach a saturation point sooner.

The figures in Table I represent gallons of water. Those in Table II pounds of soil, lost from 1/100 acre areas with different crop covers. The value of even a slight cover in checking soil loss is shown in a comparison of the figures for plots 10 and 11. Plot 10 has a cover of biennial sweet clover 2/3 inches high, and clover plants of this height are quite small, - nevertheless during the hard storm of Jan. 4th and 5th plot 10 lost less than 1/4 as much soil as plot 11 which was treated the same as bean land elsewhere in the vicinity. The cover crop on plots 8 and 9 include a small grain and as these crops grow they became increasingly effective in conserving both soil and water loss. The Sudan grass cover although mature was sparse and therefore less able to hold back as much water and soil as the small grain crops. The conclusion that cover crops including grass or small grains are most efficient in conserving water and soil during rainstorms is upheld by observations in the fields. Hay crops planted early in the fall attained sufficient size to prevent all erosion while an estimated 15% of the top soil was lost from bean land of the same soil type.

TABLE I.

WATER LOST FROM 1/100 ACRE PLOTS (In Gallons)

Plot No. and Crop	Oats & Barley 8 & Alfilaria	Oats & Bur 9 Clover	Melilotus 10 Alba	Black- 11 eye Beans	Check 12	Sudan 13 Grass
DATE						
Dec. 14	41	43	44	46	43	40
Jan. 5	126	139	226	242	235	189
Jan. 14	14	19	20	24	22	11
Jan. 19	32	35	55	59	53	5

TABLE II.

SOIL LOST FROM 1/100 ACRE PLOTS (In Pounds)

Plot No. and Crop	Oats & Barley 8 & Alfilaria	Oats & Bur 9 Clover	Melilotus 10 Alba	Black- 11 eye Beans	Check 12	Sudan Grass
Date						
Dec. 14	3	26	55	59	59	7
Jan. 5*	141	224	227	979	947	45
Jan. 14	3	40	67	94	140	13
Jan. 19	2	10	38	63	53	18

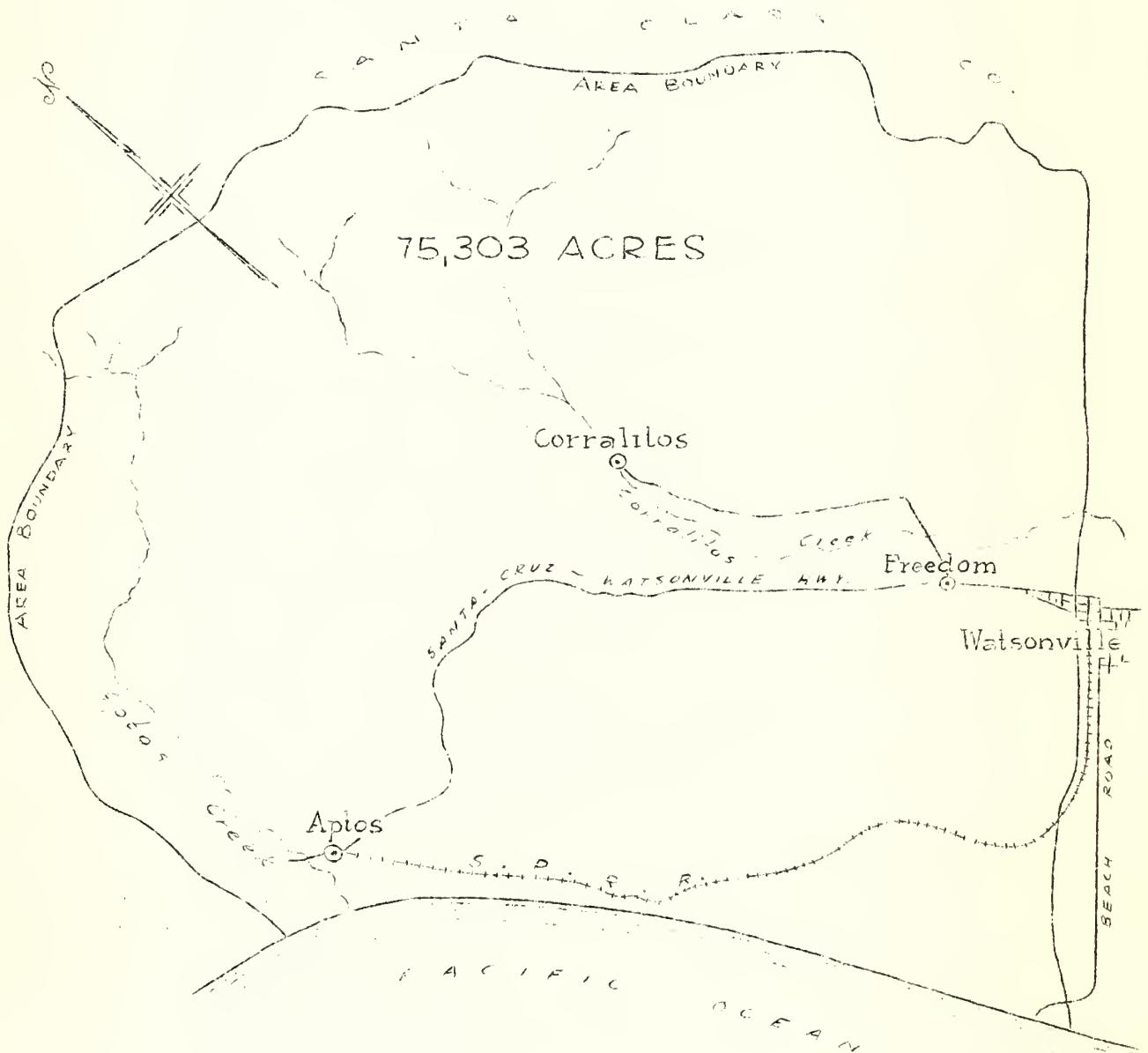
* - Converted to "tons per acre". The figures representing the results from the storm of Jan. 4 & 5, show that 7 tons of soil per acre were lost from the plot with a cover of oats, barley, and Alfilaria, while the plot which produced beans lost almost 49 tons of soil per acre. For the season 7.5 tons of soil were lost from the protected land and 58.7 tons of soil from the unprotected fallow land.

TABLE III.

RANK OF COVER IN CONSERVING SOIL AND WATER FROM SLOPES

RANK	1	2	3	4	5	6	1	2	3	4	5	6
Date of Storm	SOIL LOSS						WATER LOSS					
12-14	8	13	9	10	12	11	13	8	9	12	10	11
1-5	13	8	9	10	12	11	8	9	13	10	12	11
1-14	8	13	9	10	11	12	13	8	9	10	12	11
1-19	8	9	13	10	12	11	8	9	13	10	11	12
AVERAGE	8	13	9	10	12	11	8	9	13	10	12	11

THE CORRALITOS PROJECT



Work on the Corralitos project in Santa Cruz County is progressing favorably under the leadership of R. B. Cozzens, assistant regional director. Headquarters are at 213 Main Street, Watsonville.

The demonstration area covers 75,303 acres, and soil erosion control measures instituted there should do much to sell the idea of "saving the top

soil" to the agriculturists of surrounding regions.

Members of the staff on the new project are: Dr. Logan S. Carter, Assistant soil expert; George W. Desline, assistant agricultural engineer; Thomas Judah, junior agricultural engineer; Lawrence Aho, clerk; Thomas McGowan, Norman Farrell, and Joseph Goldsiding, draftsmen.

An aerial map of the project has been completed. Heavy equipment, including several graders, two dump trucks, and a tractor have already been delivered at the Watsonville headquarters. More than 200 laborers from the national reemployment bureau are expected to be ultimately employed on the project. Is soil erosion control work of vital necessity for the Corralitos basin project? . . . Listen . . . Estimates of the damage to soil resulting from the storm of mid-November was \$350,000. That is \$150,000 more than the appropriation for the demonstration area. Soil erosion control will prevent such tremendous losses of agricultural wealth.

SCREENINGS FROM A RUN-OFF

A. E. McClymonds, chief agronomist, left the eighteenth of February for Colorado to assume his appointment as Regional Director of U. S. Soil Erosion Service projects in that state. "Mac" (to his numerous friends) has been connected with the California project less than a year but had the agronomy work well under way. The staff of the SES in California congratulate "Mac" on his promotion and wish him success on his new job.

Facts that make one pause and think: . . . The life of the Elephant Butte Reservoir in New Mexico, originally estimated at 233 years, is now placed at about 100 years because of silting.

At the present rate of silt deposit it is estimated that the Coolidge Reservoir, in Arizona, would be filled completely within the next 80 years. Protective measures are now being started on the watershed of this dam by the Soil Erosion Service.

One of the largest land conservation programs of its kind undertaken in this country will be launched at once by the Soil Erosion Service in an area covering some 11,500,000 acres exclusive of the National Forests in the watershed of the Rio Grande in New Mexico. Land and water resources there are being rapidly depleted by accelerated soil erosion. Private lands comprise about half of the total area.

From the TARHEEL WASHOFF, HIGH POINT, NORTH CAROLINA, FEBRUARY 15, 1935. . . . "One of the most effective methods of preventing excessive runoff of rainfall, and the subsequent loss of soil, is to establish a growth of trees on severely eroded areas. Experiments at Statesville have shown that the average annual loss of soil from bare ground is 65½ tons an acre while only 2 pounds an acre were lost on forested areas".

A group of 117 agriculturists from Ventura county made a tour of the Las Posas demonstration area on the twelfth.

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Glenn E. Paxton, one of the first of the new contingent of trainees, arrived here the fourteenth. He graduated from Colorado Agricultural College in agronomy and has had graduate work in the University of California at Berkeley in plant pathology. Paxton has worked in the field of plant pathology for the past ten years, two years in Mexico with Mateo Boyd and Company, and three years in the Hawaiian Islands with a private experiment station financed by the pineapple growers.

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R. B. Cozzens, of Watsonville, has been named assistant to Regional Director Reddick for the Corralitos project in Santa Cruz county. Cozzens for 14 years held the position of general superintendent of all outside construction, including roads, bridges, and heavy grading for the Granite Rock and Construction Company of Watsonville. For the past two years he has been general superintendent of forty miles of highway in Yosemite National Park.

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The Morning Press, Santa Barbara, had a fine editorial Tuesday, February 12, on "Progress of Soil Erosion". . . . "The soil erosion experimental station with which we are best acquainted, of course, is that at Santa Paula" . . .

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Members of the staff should be interested in knowing that work has been received from Washington of the compilation of a complete bibliography on soil erosion, containing references to more than 1,160 sources of information. It was compiled by Lillian H. Wieland, secretary to H. H. Bennett, Director of the Soil Erosion Service.

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Dr. E. W. Russell, agronomist, and son of Sir John E. Russell, Director of the Rothamsted Experimental Station, Harpenden, England, visited the demonstration area in the Las Posas on the fourteenth of this month. Dr. Russell was conducted over the 25,000 acre project by J. G. Bamesberger, chief agricultural engineer.

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H. R. McConnell, superintendent of Camp 3, the evening of the eighteenth reported briefly to the staff on the recent Oklahoma conference of SES agricultural engineers. He brought out the differences existing between erosion control methods in other sections of the country and those in California. Erosion control in the Las Posas is quite a different affair from say, in Oklahoma or Missouri. Back there sod terrace outlets prevent cutting but about the only source of sod we know of here is Bermuda from some carefully tended lawn. - - That's all. Walter A. Lloyd